

Audit



Report

OFFICE OF THE INSPECTOR GENERAL

U.S. NAVY AIRCRAFT CORROSION PREVENTION
AND CONTROL PROGRAM

Report No. 97-181

June 30, 1997

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Department of Defense

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June 30, 1997

**MEMORANDUM FOR ASSISTANT SECRETARY OF THE NAVY (FINANCIAL
MANAGEMENT AND COMPTROLLER)**

**SUBJECT: Audit Report on U.S. Navy Aircraft Corrosion Prevention and Control
Program (Report No. 97-181)**

We are providing this report for review and comment. This report is the fifth in a series of reports resulting from our DoD-wide Audit of Aircraft Paint Application and Removal Capabilities. We considered management comments on a draft of this report when preparing the final report.

DoD Directive 7650.3 requires that all recommendations be resolved promptly. Therefore, we request that, the Navy provide additional comments on Recommendations 1., 2., 3., and 4., and that the Navy reconsider its position on potential monetary benefits. We request management provide comments by July 31, 1997.

We appreciate the courtesies extended to the audit staff. Questions on the audit should be directed to Mr. John A. Gannon, Audit Program Director, at (703) 604-9176 (DSN 664-9176) or Mr. Gerald P. Montoya, Audit Project Manager, at (303) 676-7445 (DSN 926-7445). See Appendix D for the report distribution. The audit team members are listed inside the back cover.

David K. Steensma

David K. Steensma
Deputy Assistant Inspector General
for Auditing

Office of the Inspector General, DoD

Report No. 97-181
(Project No. 4LB-0027.03)

June 30, 1997

U.S. Navy Aircraft Corrosion Prevention and Control Program

Executive Summary

Introduction. This report is the fifth in a series of reports that resulted from our DoD-wide Audit of Aircraft Paint Application and Removal Capabilities (Project No. 4LB-0027). In other reports we discussed the repainting of the C-5 aircraft; the construction of a plastic media blasting facility at Laughlin Air Force Base, Texas; the Air Force aircraft painting and corrosion control; and the Marine Corps corrosion prevention and control program. All Navy organizations responsible for aircraft maintenance are required to establish a comprehensive corrosion prevention and control program with trained personnel for the prevention, early detection, reporting, and repair of corrosion damage. Such a program requires a dedicated effort by all maintenance personnel to prevent corrosion before it starts. Those efforts will improve the operational readiness of aircraft and minimize costly repairs.

Audit Objectives. The primary objective for this phase of the DoD-wide audit was to evaluate the effectiveness of the Navy Aircraft Corrosion Prevention and Control Program at the organizational level. We also evaluated the adequacy of the Navy management control program as it applied to the primary audit objective.

Audit Results. The Navy painted its aircraft more than needed at the organizational level. From August 1, 1995, through August 1, 1996, the 19 F/A-18 fighter squadrons we reviewed applied, on average, 341 percent more paint than was necessary for the prevention and control of corrosion damage, and 7 F-14 squadrons were painting large sections of their aircraft every 56 days. The Navy can reduce organizational maintenance cost by \$1.7 million over the 6-year Future Years Defense Program by limiting aircraft painting to touch-up only. In addition, Navy fighter squadrons routinely painted large sections of or entire aircraft in their hangars contrary to Navy maintenance, health, and safety regulations. As a result, Navy squadrons may be endangering the health and safety of Navy personnel because aircraft painting at the organizational level exposes personnel to hazardous levels of toxic chemicals and potential fire hazard.

Summary of Recommendations. We recommend that naval aviation squadrons cease painting large sections of or entire aircraft in hangars, limit aircraft painting to minor touch-up, locate existing adequate facilities to perform complete painting of Navy aircraft, direct naval air station base safety officers and fire safety officers to document all cases and complaints involving the hazardous painting of aircraft in hangars, and direct Navy medical authorities and industrial hygiene officials to fully document suspected cases of isocyanate exposure and to report the information to senior Navy management.

Management Comments. The Office of the Assistant Secretary of the Navy for Research, Development and Acquisition generally concurred with the report and stated that Navy policy concerning aircraft painting and touch-up are clearly documented in appropriate maintenance manuals and wing commanders would be tasked to include visual evaluations of paint systems during command inspections by May 30, 1997; entire aircraft painting should not be required outside of scheduled depot level maintenance periods, except in highly unusual circumstances, fire and safety reports are submitted through the Commander, Shore Activities chain-of-command, and finally, that any documented cases of isocyanate exposure should be reported to the appropriate naval air force commander. However, he questioned the amount of potential monetary benefits based on considerations of actual paint usage and scrap rates. See Part I for a complete discussion of management comments and Part III for the complete text of management comments.

Audit Response. Although Navy policy on aircraft painting and touch-up is clear, more forceful measures are needed to ensure that aviation squadrons are complying. The Navy agreed to locate and use existing facilities to paint entire aircraft when necessary but did not indicate how or when this corrective action would occur. Our concern with the effectiveness of base level corrective actions taken in response to fire and safety reports is intended to raise the level of awareness of naval air force commanders and thereby ensure that follow-up actions are taken. The Navy needs to provide information regarding a plan or summary of corrective actions to include procedures to be followed in submitting and following up on those reports. The reporting of cases of isocyanate exposure to the naval air force commanders is an important step to ensure that prompt effective actions are taken to prevent additional exposure to toxic chemicals. We took into account the scrap rate when calculating the potential monetary benefits. We maintain that the potential monetary benefit reported is reasonable and represents a good measurement of actual amounts of paint applied to aircraft. Therefore, we request that the Navy provide additional comments in response to the final report by July 31, 1997.

Table of Contents

Executive Summary	i
Part I - Audit Results	
Audit Background	2
Audit Objectives	2
Navy Aircraft Painting at Organizational Level	3
Part II - Additional Information	
Appendix A. Audit Process	14
Scope	15
Methodology	15
Management Control Program	17
Appendix B. Summary of Prior Audits and Other Reviews	20
Appendix C. Analysis of F/A-18 Painting by Squadron	20
Appendix D. Report Distribution	21
Part III - Management Comments	
Department of the Navy Comments	24

Part I - Audit Results

Audit Background

This report is the fifth in a series of reports that resulted from our DoD-wide Audit of Aircraft Paint Application and Removal Capabilities (Project No. 4LB-0027). In other reports, we discussed the repainting of the C-5 aircraft; the construction of a plastic media blasting facility at Laughlin Air Force Base, Texas; the Air Force aircraft painting and corrosion control; and the Marine Corps corrosion prevention and control program. All Navy organizations responsible for aircraft maintenance are required to establish a comprehensive corrosion prevention and control program with trained personnel for the prevention, early detection, reporting, and repair of corrosion damage. Such a program requires a dedicated effort by all maintenance personnel to prevent corrosion before it starts. Those efforts will improve the operational readiness of aircraft and minimize costly repairs.

Audit Objectives

The primary objective for this phase of the DoD-wide audit was to evaluate the effectiveness of the Navy Aircraft Corrosion Prevention and Control Program at the organizational level. We also evaluated the adequacy of the Navy management control program as it applied to the primary audit objective. See Appendix A for a discussion of scope, methodology, and the management control program and Appendix B for a discussion of prior audits and other reviews.

Navy Aircraft Painting at Organizational Level

The Navy painted its aircraft more than needed at the organizational level. The 19 F/A-18 fighter squadrons we reviewed applied, on average, 341 percent more paint than was necessary for the prevention and control of corrosion damage, and 7 F-14 squadrons were painting large sections of its aircraft every 56 days. In addition, Navy fighter squadrons routinely painted large sections of or entire aircraft in their hangars, contrary to Navy maintenance, health, and safety regulations. The conditions existed because Navy squadrons did not comply with Navy regulations, which required the painting of aircraft primarily to control and to prevent corrosion rather than for cosmetic purposes. As a result, Navy squadrons may be unnecessarily endangering the health and safety of Navy personnel because excessive aircraft painting at the organizational level exposes personnel to hazardous levels of toxic chemicals and is a potential fire hazard. In addition, the Navy can reduce organizational level maintenance cost by \$1.7 million over the 6-year Future Years Defense Program by limiting aircraft painting to touch-up only.

Navy Aircraft Painting

The primary objective of painting Navy aircraft is to protect exposed surfaces and components against corrosion and other forms of deterioration. Maintenance and repair of paint finishes are extremely important, beginning with the aircraft weapon systems development and continuing with constant surveillance throughout the service life of the systems. Naval aviation corrosion prevention and control begins at the organizational or squadron level. The Navy uses small paint kits to touch up the paint finishes of aircraft assigned to operational squadrons.

Frequency of Organizational Level Aircraft Painting

The Navy painted its aircraft more than needed at the organizational level. The 19 F/A-18 fighter squadrons we reviewed applied, on average, 341 percent more paint than was necessary for the prevention and control of corrosion damage, and 7 F-14 squadrons were painting large sections of their aircraft every 56 days. In addition, Navy fighter squadrons routinely painted entire aircraft in their hangars, contrary to Navy maintenance, health, and safety regulations.

Navy Aircraft Painting at Organizational Level

Paint Usage at F/A-18 Squadrons. We analyzed the paint usage for 279 aircraft assigned to 19 F/A-18 active duty squadrons. The aircraft were assigned to Naval Air Station (NAS) Cecil Field, Jacksonville, Florida, and NAS Lemoore, California. According to Navy aircraft paint experts, the maximum amount of paint required to perform standard touch-up painting during normal corrosion prevention and control inspections for 279 aircraft should have been 2,240 paint kits during the 12-month period. The finding was based on the use of one touch-up paint kit per aircraft, per scheduled corrosion treatment cycle. In contrast, paint usage records showed that F/A-18 squadrons used 7,648 paint kits during the 1-year period. Based on that analysis, we calculated that squadrons used 5,408 or 341 percent more paint kits than were needed for normal aircraft corrosion prevention and control. Our review of painting procedures at F/A-18 squadrons showed that squadrons normally applied more paint than was necessary for standard aircraft touch-up painting during corrosion prevention and control by painting either large sections of the aircraft or the entire aircraft. See Appendix C for a detailed paint analysis by squadron.

F/A-18 Aircraft at NAS Fallon. We believe that other F/A-18 squadrons also painted their aircraft more than needed at the organizational level. Although we were unable to calculate exact quantities of paint usage, contractor personnel at NAS Fallon, Nevada, regularly painted in their entirety the aircraft assigned to the base, in addition to performing other aircraft maintenance services. For example, the Navy tasked the contractor to repaint 19 of 34 F/A-18 aircraft in FY 1997. According to contractor personnel, the Navy may increase that number at a later date.

Usage of Paint at F-14 Squadrons. Although we were unable to determine the exact quantities of paint used at F-14 squadrons, seven F-14 squadrons that we reviewed commonly applied more paint than was necessary for corrosion prevention and control. At NAS Oceana, Norfolk, Virginia, squadrons painted large sections of aircraft every 56 days. As a general rule, squadrons were allowed to paint 25 percent of the surface of each assigned aircraft at every inspection interval. As a result, an aircraft would have been completely repainted after four inspection intervals, assuming that 25 percent of the aircraft surface was painted at each interval. Squadron personnel confirmed that large sections of aircraft surfaces were painted every 56 days and acknowledged that sometimes entire aircraft had been painted in the squadron hangars.

All squadrons we visited painted aircraft in their hangars. In addition to touch-up painting, most squadrons routinely painted entire aircraft in their hangars.

Compliance With Navy Regulations

Unnecessary aircraft painting occurred because Navy squadrons did not comply with Navy regulations to paint aircraft primarily to control and prevent corrosion rather than for cosmetic purposes.

Navy Technical Manual. Navy Technical Manual 01-1A-509, "Aircraft Weapons Systems Cleaning and Corrosion Control," January 1, 1992, section 7-3, states that repainting solely for the sake of cosmetic appearance shall not be done. According to the Manual, a faded or stained but well bonded paint finish is better than a fresh touch-up treatment. In addition, refinishing is to be performed only when existing paint finishes have deteriorated or have been damaged, or when removal of the existing paint system is necessary for corrosion corrective actions. Despite the Navy guidelines, all squadrons had painted entire aircraft in their hangars.

Navy Instruction. Commander, Naval Air Force, U.S. Atlantic Fleet Instruction 4750.5D, and Commander, Naval Air Force, U.S. Pacific Fleet Instruction 4750.4A, "Organizational and Intermediate Maintenance Activities Aeronautical Equipment Paint Touch-Up and Marking and Support Equipment Painting," June 15, 1992, section 3.a., states that complete repainting of entire sections of the aircraft at fleet levels of maintenance is specifically prohibited except when authorized in writing by the type commander.

Interpretation of Navy Instructions. The F-14 squadrons at NAS Oceana believed they were authorized to paint large sections of aircraft based on their interpretation of a local instruction. Although Navy guidance prohibits the repainting of large sections of aircraft, NAS Oceana established NAS Oceana Instruction 5100.1B, "Spray Painting of Aircraft in Hangars," October 1, 1995, which states that adequate facilities are not available at NAS Oceana for spray painting of aircraft. But the instruction authorizes limited spray painting in hangars. The instruction states that painting is limited to 56-day corrosion control touch-up and will not involve more than 25 percent of the aircraft surface at one time. However, squadrons interpreted that instruction to mean that 25 percent of the aircraft can be painted every 56 days. As a result of the misinterpretation of the instruction, F-14 squadrons routinely performed excessive painting of their aircraft contrary to other Navy guidelines.

Concern Over Aircraft Painting. In addition to numerous Navy regulations and instructions prohibiting cosmetic painting of aircraft, a message from the Commander, Naval Air Force, U.S. Atlantic Fleet, May 1995, expressed concerns over the amount of painting taking place at organization level. The message stated that during a visit to various squadrons, "... excess touch-up painting is commonly noted ... squadrons are only authorized to restore the paint area damaged during corrosion repair procedures. Repainting of entire sections of aircraft or deviation from tactical paint scheme requirements are specifically prohibited"

Potential Health and Safety Problems

Navy squadrons may be unnecessarily endangering the health and safety of Navy personnel because of excessive aircraft painting at the organizational level. Aircraft painting in hangars exposes military and civilian personnel to hazardous levels of toxic chemicals and is a potential fire hazard.

Personnel Exposure to Toxic Chemicals. Navy Technical Manual 01-1A-509, provides the basic requirement for the use of polyurethane paint. Polyurethane paint is the primary coating used on Navy aircraft. The material requires special precautions during mixing, applying, and drying because of the isocyanate vapors produced. Isocyanates released during painting operations can produce significant irritation of the skin, eyes, and respiratory tract, even in very small concentrations. They may also induce allergic sensitization of personnel exposed to the vapors and mists produced during spray application. Sensitization is characterized by bronchial constriction, causing difficulty in breathing, dry cough, and shortness of breath. Once sensitized, many workers cannot tolerate even a minimum subsequent exposure to isocyanates, and must thereafter avoid work areas where such exposure could occur. Technical Manual 01-1A-509 states that all personnel to assigned duties involving the mixing and applying of polyurethane paint are to receive a baseline medical evaluation followed by periodic medical surveillance examinations, if recommended by an industrial hygiene survey report. The purpose of the survey report is to assess the status of occupational health hazards in the workplace. Personnel applying polyurethane paint must wear protective clothing, including chemical or splash proof goggles, coveralls, gloves, and a respirator.

Centers for Disease Control and Prevention Alert. The Centers for Disease Control and Prevention issued a National Institute for Occupational Safety and Health alert, "Request for Assistance in Preventing Asthma and Death for Diisocyanate [also known as isocyanate] Exposure," March 1996. The alert warns that workers exposed to isocyanates may develop a serious or fatal respiratory disease. The alert summarizes seven case reports of disease and deaths following occupational exposure to isocyanates. According to the alert, information about preventing adverse health effects from exposure to isocyanates is urgently needed by worker, employers, and others exposed to isocyanates. In addition, death from severe asthma in sensitized persons has been reported. Data from recent studies by the International Agency for Research on Cancer and the World Health Organization concluded that a form of isocyanate should be treated as a potential human carcinogen.

Documentation of Cases of Overexposure to Isocyanates. At the bases we visited, military personnel all suspected cases of overexposure to isocyanates. However, safety, medical, and maintenance personnel we interviewed could not recall specific dates of incidents or the personnel involved. One of the difficulties in documenting cases of overexposure to isocyanates is that isocyanates are odorless and tasteless. As a result, personnel can become ill and not know what caused the illness. Further, personnel may not seek medical assistance because overexposure resembles other illness.

For example, a Naval Aviation Hazard Report, May 1996, detailed a possible allergic reaction to isocyanates occurring at NAS Barbers Point, Hawaii. A maintenance technician was mixing polyurethane paint. Although he was wearing protective gear, such as a respirator; gloves; goggles; and a paint suit, his eyes became irritated and he had difficulty breathing. The report stated that he did not feel bad enough to stop working. He finished mixing the paint and began assisting others around the aircraft being painting. Approximately 2-3 hours later, his breathing became more difficult, and he felt nauseous. His supervisor directed him to report to the medical clinic but he remained in the shop spaces until the end of his shift 2 hours later. At the end of his shift, the person returned to the barracks. Approximately, 6 hours latter, the person telephoned the squadron stating that his breathing was difficult, he was nauseous, and his face and eyes were badly swollen. The individual was dispatched to the hospital where he was diagnosed as having possible allergic reaction to isocyanates. Further investigation revealed that the person had been issued an improper respirator, which did not protect him from the isocyanates in the polyurethane paint.

Safety at Dedicated Paint Facilities. The Air Force also allows aircraft to be repainted at the field level. Although safety is a concern, safety complaints were less frequent because the Air Force had dedicated paint facilities at each of its bases. As a result, only a limited number of Air Force personnel are exposed to painting operations. At the Navy bases we visited, aircraft painting was performed in hangars alongside other aircraft maintenance activities. In most cases, aircraft were parked side-by-side. While one protected crew is painting an aircraft, another unprotected crew may be performing other maintenance tasks on an aircraft nearby. As a result, personnel may be unnecessarily exposed to toxic paint vapors. Base Safety Officers at NAS Cecil Field; NAS Fallon; NAS Lemoore; NAS Mayport, Florida; and NAS Oceana have received complaints from personnel concerned with their personal health because of spray painting of aircraft in the hangars. A complaint dated September 25, 1995, at NAS Oceana, stated that maintenance personnel were continuously ordered to sand and paint aircraft while other maintenance personnel are performing maintenance tasks on the same aircraft. Unprotected personnel were being exposed to paint dust, epoxy polyamide paint mist, strontium chromates, thinners, and polyurethane paint. The complaint stated that immediately after an aircraft was completely painted with polyurethane paint, unprotected personnel were within the 40-foot safety zone of a freshly painted aircraft, which resulted in personnel being unnecessarily exposed to isocyanate vapors. In a similar complaint at NAS Oceana, dated April 5, 1996, the individual was reluctant to report the safety concerns to the squadron supervisors because of the belief that no action would be taken to correct the problem.

Fire Hazards of Aircraft Painting. Not only is aircraft painting in Navy maintenance hangars restricted because of the potential health effects to personnel, but because painting in maintenance hangars is a potential fire hazard. The principal fire hazard of spray painting in the aircraft hangars comes from flammable liquids and their vapors and from highly combustible residues that may be deposited in the area. Vapors from volatile flammable liquids form explosive mixtures with air and deposits of paint residue may ignite

Navy Aircraft Painting at Organizational Level

spontaneously. Fires involving flammable liquids or combustible residues start easily, spread rapidly, and produce intense heat. A fire in a typical Navy aviation maintenance hangar could result in significant loss of life, of valuable assets, of facilities, and of equipment.

Enforcement of Fire Codes. During fire inspections, fire departments at NAS Cecil Field; NAS Fallon; NAS Lemoore; and NAS Oceana routinely identified potential fire hazards resulting from painting entire aircraft in their hangars. From June 1994 through July 1996, fire inspectors identified 11 such incidents and reported them to air station commanders. For example, in a memorandum dated July 22, 1996, NAS Cecil Field fire chief stated that during a daily flightline inspection, a squadron was observed preparing an aircraft for a complete paint job. The memorandum to the squadron commander stated that complete repainting of aircraft on base was strictly prohibited. In addition to the potential fire hazard, the fire chief stated, "Continued practice of painting aircraft in hangars will eventually diminish the protection provided by fire suppression equipment, and will increase the potential loss of life and property." Fire suppression equipment is smoke or fire detection sensors. They can be rendered inoperable because the paint spray can get into the sensors causing them to fail to detect smoke or heat.

Spark Producing Devices. Another problem with painting in hangars is the number of spark producing devices that can ignite a fire in a hangar. For example, the Chief Fire Inspector, NAS Lemoore, expressed concern about electrical equipment and vending machines used in the hangar area where painting is occurring. He noted in a December 6, 1994, memorandum, that such devices either be removed from the hangar bays or be placed at least 20 inches high, to be well above any concentration of paint fumes that tend to settle.

Effectiveness of Base Level Corrective Actions. Base level corrective actions have been ineffective because no process or procedures ensure that corrective actions are implemented. Corrective actions were further complicated because the issue of personnel safety and health in aircraft hangars falls under four different areas of oversight responsibility. Base safety officers, fire safety officers, industrial hygienists, and medical personnel all have a segment of responsibility for identifying and reporting health and safety problems. Although the four areas report safety problems to the base commanders, no formal mechanism was in place to ensure that commanders addressed safety concerns and took corrective actions, if warranted. Fire inspectors have routinely detected fire hazards associated with painting aircraft in hangars, but they informed us that base commanders disregarded reports of those violations. For example, records at NAS Cecil Field showed that painting aircraft in the hangars was a safety concern dating back to 1989, yet we verified that the safety concern still existed in 1996. As a result, we believe that the Navy should formalize procedures to ensure that health and safety problems are identified and fully documented, including the reporting of and corrective action taken to resolve the problems. We also believe that health and safety problems should also be reported to the Commanders, Naval Air Forces, U.S. Atlantic Fleet and U.S. Pacific Fleet so that health and safety problems can be effectively monitored to ensure that corrective actions are taken. The Navy may want to

consider making the aircraft corrosion prevention and control program a matter of special interest during reviews made by the Navy Inspector General.

Potential Monetary Benefits

The Navy can reduce its aircraft maintenance cost by \$1.7 million over the 6-year Future Years Defense Program by limiting aircraft painting to touch-up only. We examined the paint usage for 279 aircraft assigned to NAS Cecil Field and NAS Lemoore for the period August 1, 1995, through August 1, 1996. During the period, the 19 squadrons used 5,407 more paint kits than was necessary. Based on the 6-year Future Years Defense Program, the Navy can realize potential monetary benefits of \$1.7 million for 483 aircraft in the Navy inventory by enforcing its guidelines, and can put the funds to better use. See Appendix C for a detailed paint usage analysis.

Recommendations, Management Comments, and Audit Response

We recommend that the Commander, Naval Air Force, U.S. Atlantic Fleet and the Commander, Naval Air Force, U.S. Pacific Fleet:

1. Direct that naval aviation squadrons cease painting large sections of or entire aircraft in hangars, and limit aircraft painting to minor touch-up.

Navy Comments. The Navy concurred with the recommendation and stated that the Navy policy concerning aircraft painting and touch-up is clearly outlined in the appropriate maintenance manuals. Navy aircraft corrosion and prevention policy will be reiterated to squadron and wing commanders via official correspondence from the type commanders. Wing commanders will be tasked to include visual evaluations of paint systems during command inspections. The Navy plans to complete this process by May 30, 1997.

Audit Response. The Navy comments are partially responsive. We agree that the Navy policy concerning aircraft painting and touch-up is clearly outlined in appropriate aircraft maintenance manuals and Navy instructions. However, the audit showed that aviation squadrons are simply not complying with Navy policy. More forceful measures such as clear directions from naval air force commanders are needed to instill painting discipline at the squadron level. We request that the Navy provide us with additional information including copies of official correspondence and the summary results of aircraft inspections to verify that the planned corrective actions will reinforce existing policies guidelines.

Navy Aircraft Painting at Organizational Level

2. Locate and use existing adequate facilities to paint Navy aircraft in their entirety when entire aircraft painting is needed.

Navy Comments. The Navy concurred with the recommendation and stated that except in highly unusual circumstances, entire aircraft painting should not be required outside of scheduled depot level maintenance periods. If entire aircraft painting is deemed necessary, authority must be granted in writing by the type commander.

Audit Response. The Navy comments are partially responsive and indicative of a desire to enforce compliance with Navy policy and institute fundamental reforms in aircraft painting at the squadron level. However, the Navy has not indicated how it will locate and subsequently use existing adequate facilities. We request that the Navy provide us with the dates these actions have been or will be taken and a summary or plan describing how a squadron or wing will request approval from the type commander.

3. Direct base safety officers and fire safety officers at naval air stations to fully document all cases and complaints involving hazardous painting of aircraft in hangars so that station commanders can initiate appropriate corrective actions. Base safety officers and fire safety officers should also provide copies of safety hazard reports to the appropriate naval air force commander.

Navy Comments. The Navy concurred with the recommendation. Reports are submitted via Commander, Shore Activities chain-of-command.

Audit Response. The Navy comments are partially responsive. Fire and safety reports are already provided to the base commanders. The intent of the recommendation is to raise the level of awareness of naval air force commanders of conditions at units and facilities under their control, and thereby ensure that followup on corrective actions are taken on fire and safety conditions reported. Accordingly, we request that the Navy provide us with a plan or summary of corrective actions taken to include the procedures to be followed in submitting and following up on those reports, along with the dates corrective actions are planned or taken.

4. Direct Navy medical authorities and industrial hygiene officials to fully document suspected cases of isocyanate exposure and to report the information to senior Navy management.

Navy Comments. The Navy concurred with the recommendation. Any documented cases should be reported to appropriate naval air force commander.

Audit Response. The Navy comments are partially responsive. The intent of the Navy to report any documented cases of isocyanate exposure to naval air force commanders is an important step to ensure that prompt effective actions are taken to prevent additional exposure to toxic chemicals. However, the Navy did not indicate what corrective actions would be taken or the dates when

additional exposure to toxic chemicals. However, the Navy did not indicate what corrective actions would be taken or the dates when actions would be completed. We request that the Navy provide information on how isocyanate exposure cases will be documented and reported and the completion date of those corrective actions.

Management Comments on Potential Monetary Benefits and Audit Response

Navy Comments. The Navy partially concurred, stating that review of paint usage data as part of the audit process, as detailed in Appendix A of the draft report, may accurately capture the monetary value of paint and its potential impact on the environment, but it does not necessarily equate to the amount of paint actually applied to the aircraft. Connecting health risks to inflated usage data can also lead to false conclusions. There is a "scrap rate" associated with paint kits. The "scrap rate" may be influenced by several factors. Not all paint kits are successfully mixed and used: some chemically fail because environmental conditions are inappropriate, shelf life or hazardous material storage limits are exceeded, surface preparation is improper, or other reasons. More importantly, once a kit is mixed, actual usage depends upon individual aircraft requirements.

Audit Response. When calculating the potential monetary benefits, we applied the "scrap rate" to the cost of painting 19 F/A 18 squadrons based on inventory records showing excess paint returned to storage for reuse and from hazardous material disposal records. Based on our review, we maintain that the potential monetary benefit reported is reasonable and represents a good measurement of actual amounts of paint applied to aircraft. Further, in reviewing the Navy comments, it appears that the Navy agrees that waste exists in painting naval aircraft but questions whether the paint wasted is caused by excessive painting or from waste when disposing of paint (scrap rate). As a result, we request that the Navy reconsider its position on potential monetary benefits.

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Part II - Additional Information

Appendix A. Audit Process

Scope

We reviewed policies and guidelines on the Navy Aircraft Corrosion Prevention and Control Program including Navy Technical Manual 01-1A-509, Commander, Naval Air Force, U.S. Atlantic Fleet Instruction 4750.5D and Commander, Naval Air Force, U.S. Pacific Fleet Instruction 4750.4A. We also reviewed the National Fire Protection Association Standards on Aircraft Hangars and reviewed U.S. Department of Human Services, National Institute of Occupational Safety and Health Standards on Diisocyanates, and the Centers for Disease Control and Prevention Alert, "Request for Assistance in Preventing Asthma and Death from Diisocyanate Exposure."

Review of Paint Usage Data. We reviewed aircraft paint usage data as compiled by base supply offices located NAS Cecil Field, NAS Fallon, NAS Lemoore, NAS Mayport, and NAS Oceana to determine the paint usage of various squadrons located at each base. We limited our analysis of paint usage data to bases where the data we obtained were complete, accurate, reliable, and consistent. For example, paint usage data from NAS Mayport and NAS Oceana were inadequate for determining the paint usage for our analysis and was not used. As a result, we used only paint usage data for 19 F-18 squadrons located at NAS Cecil Field and NAS Lemoore for the 12-month period from August 1, 1995, through August 1, 1996, for our analysis.

Aircraft Corrosion Control Inspection Records. We reviewed the October 1995 through May 1996 aircraft corrosion inspection records for 217 of 378 aircraft assigned to NAS Cecil Field, NAS Fallon, NAS Lemoore, and NAS Oceana, to determine whether inspections were performed in accordance with the Office of the Chief of Naval Operations Instruction 4790.2F, "Naval Aviation Maintenance Program," June 1, 1995. We reviewed inspection records of F-14 and F/A-18 aircraft.

Base Safety Officers, Fire Safety Officers, Medical Personnel, and Industrial Hygiene Reports. We interviewed base safety officers, fire safety officers, industrial hygienists, and medical personnel located at NAS Cecil Field, NAS Fallon, NAS Lemoore, NAS Mayport, and NAS Oceana, to determine whether they had identified any health and safety problems related to aircraft painting at the organizational level. Additionally we reviewed safety complaints maintained by the base safety officers, fire safety violations, and industrial hygienist reports from May through September 1996.

Methodology

Use of Computer-Processed Data. To achieve the audit objective, we relied on computer-processed data contained in the Naval Hazardous Inventory Control System. Although we did not perform a formal reliability assessment of the computer-processed data, we determined that the national stock numbers, issue dates, and squadron inventory control points generally agreed with the information in the computer-processed data. We did not find errors that would preclude the use of computer-processed data to meet the audit objectives or that would change the results of this audit.

Audit Period and Standards. We performed this economy and efficiency audit from February through December 1996, in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD. Accordingly, we included tests of management controls considered necessary.

Contacts During the Audit. We visited or contacted individuals and organizations within the DoD. Further details are available on request.

Statistical Sampling Methodology. We used nonstatistical sampling methods to select corrosion inspection records for review at each of the Navy squadrons. The selection criteria included geographic location, squadron size, aircraft type, and other criteria to determine whether Navy corrosion prevention and control policies and procedures were implemented consistently. Corrosion inspection records were not consistently recorded. As a result, we relied on various sources of information to determine the adequacy of corrosion control inspections and preventive maintenance. We were provided aircraft paint usage data from NAS Cecil Field, NAS Fallon, NAS Lemoore, NAS Mayport, and NAS Oceana. The data were supplemented with interviews of knowledgeable depot and squadron personnel. Statistical sampling methods were not needed or applied.

Management Control Program

DoD Directive 5010.38, "Internal Management Control Program," April 14, 1987,* requires DoD organizations to implement a comprehensive system of management controls that provides reasonable assurance that programs are operating as intended and to evaluate the adequacy of the controls.

Scope of Review of Management Control Programs. The audit evaluated management controls related to aircraft corrosion control at Navy squadrons.

* DoD Directive 5010.38 has been revised as "Management Control Program," August 26, 1996. The audit was performed under the April 1987 version of the Directive.

Appendix A. Audit Process

Specifically, we examined the management control procedures for corrosion control inspections in accordance with applicable Navy guidance, policies, and procedures.

Adequacy of Management Controls. Navy management controls we reviewed were adequate. We identified no material management control weaknesses.

Adequacy of Management's Self-Evaluation. Navy officials identified management and administration of the aircraft corrosion prevention and control program as an assessable unit and did not identify any material management control weaknesses.

Appendix B. Summary of Prior Audits and Other Reviews

During the last 5 years, the General Accounting Office and the Office of the Inspector General, DoD, issued reports and other reviews that discussed aircraft painting and corrosion control programs.

General Accounting Office

General Accounting Office, Letter B-257911, July 19, 1994. The General Accounting Office provided letter B-257911 to the Chairman, House Subcommittee on Environment, Energy and Natural Resources, Committee on Government Operations. The letter indicated that the General Accounting Office had identified more than \$24 million in potential reductions in the Air Force FY 1995 programmed depot maintenance request. The General Accounting Office believed that the repaint requirements for the C-5 aircraft and C-141 aircraft were overstated by about \$20.8 million and \$3.5 million, respectively. The General Accounting Office made no recommendations in its letter.

Inspector General, DoD

The Inspector General, DoD, issued Report No. 97-015, "U.S. Marine Corps Aircraft Corrosion Prevention and Control Program," October 31, 1996. The report states that Marine Corps squadrons can improve performance of aircraft corrosion control and preventive maintenance, including performing inspections and repairing corrosion damage in accordance with aircraft maintenance requirements. All 21 squadrons reviewed had incomplete inspection records, and of the inspections that had been performed, the Marine Corps did not perform 64 of 292 corrosion inspections within the required inspection frequency intervals. Further, as disclosed in depot inspection reports, organizational corrosion maintenance was inadequate for prevention of aircraft damage. As a result, Marine Corps aircraft depot repair costs related to corrosion damage increased by more than \$49.4 million projected over the 6-year Future Years Defense Program. The costs may be avoided with improved corrosion control and preventive maintenance at the organizational level because it will minimize repairs at the depot. The report recommended that the Marine Corps reestablish an effective aircraft corrosion prevention and control program; provide sufficient personnel manning levels to perform corrosion control and preventive maintenance at the organizational level; modify existing military occupational specialties, as necessary; and implement a time-phase plan to train personnel to meet minimum corrosion control and preventive maintenance requirements. The Marine Corps generally concurred with the

Appendix B. Summary of Prior Audits and Other Reviews

audit recommendations. Although the Marine Corps acknowledged that potential monetary benefits exist, it did not agree with the amount of projected monetary benefits estimated in the audit. Based on discussions held with Marine Corps officials in May 1997, concerning that matter, they decided to perform a review of their aircraft maintenance function to better analyze expected monetary benefits. This review will be conducted by June 30, 1998.

Inspector General, DoD, issued Report No. 96-062, "Air Force Aircraft Painting and Corrosion Control," January 24, 1996. The report states that the Air Force major commands were painting aircraft primarily to improve aircraft appearance rather than to control and prevent corrosion. As a result, major commands incurred unnecessary expenses to paint 142 of 377 fighter and training aircraft more frequently than needed. They were also acquiring additional painting capacity even though existing Air Force facilities were not used to their maximum capacity. The report states that the Air Force could reduce costs of \$16.1 million over the 6-year Future Years Defense Program by reducing the frequency with which aircraft were painted. Additional benefits could have been realized through better utilization of existing painting facilities and by discontinuing the acquisition of new and unnecessary aircraft paint facilities. The report recommended that the Air Force reprogram funds for aircraft painting to other needs, direct a review of major command policies to ensure conformance with existing Air Force policy, place a moratorium on the establishment of additional paint stripping and repainting facilities, make use of existing paint stripping and painting capacity before establishing new capabilities, issue guidance to change aircraft painting cycles, and cancel plans for solicitation and award of a contract for stripping and painting of fighter aircraft. The Air Force concurred with the recommendations to reprogram funds for aircraft painting, pending resolution of recommendations to change painting cycles and to direct a review of major command policies. The Air Force partially concurred with placing a moratorium on additional corrosion control facilities. The Air Force also agreed to make use of existing paint stripping and painting capacity before pursuing contract support and to change aircraft paint cycles by issuing guidance directing major commands to repaint aircraft based on the condition of aircraft. Additionally, the Air Force initiated an Air Force-wide review of command painting procedures to ensure guidance conforms to current Air Force policy.

The Inspector General, DoD, issued Report No. 95-183, "Construction of a Plastic Media Blasting Facility, Laughlin Air Force Base, Texas," May 3, 1995. The report states that the Air Force was planning to construct a plastic media blasting facility at Laughlin Air Force Base to strip paint from aircraft even though existing Air Force facilities and equipment would accommodate the paint stripping work load. The report recommended that the Air Force terminate the planned construction of the plastic media blasting facility and the acquisition of related equipment for Laughlin Air Force Base and modify the paint stripping facility at Columbus Air Force Base, Mississippi, to accommodate the T-1 aircraft at the field level. The Air Force agreed to terminate the planned construction of the plastic media blasting facility and acquisition of related equipment for Laughlin Air Force Base, and to modify the paint stripping facility at Columbus Air Force Base to accommodate the T-1 aircraft. The Air Force partially agreed to discontinue plans to strip paint from

Appendix B. Summary of Prior Audits and Other Reviews

F-15 and F-16 aircraft at the organizational level. It agreed to discontinue paint stripping of the F-15, but stated that it plans to continue stripping and repainting of F-16 aircraft at the field level because it is done at considerably less cost. The Air Force performed a study to validate costs associated with stripping and repainting F-16 aircraft.

The Inspector General, DoD, issued Report No. 94-198, "Quick-Reaction Report on Repainting of the C-5 Aircraft," September 29, 1994. The report states that the Air Force was repainting C-5 aircraft ahead of their repainting service intervals even though the aircraft did not need repainting. By repainting C-5 aircraft prematurely, the Air Force was incurring unnecessary costs of approximately \$59.3 million over the 6-year Future Years Defense Program. The report recommended that the Air Force suspend the accelerated painting of C-5 aircraft and paint only those aircraft that qualified for repainting. The Air Force agreed and discontinued unnecessary painting of the C-5 aircraft. The Air Force also implemented repainting guidelines to eliminate unnecessary painting.

Appendix C. Analysis of F/A-18 Painting by Squadron

This chart represents the amount of paint in quarts used in excess of what should have been needed for standard touch-up painting. The total monetary benefits that can be realized by eliminating excessive painting is \$1.7 million¹ over the 6-year Future Years Defense Program.

<u>Squadron</u>	<u>Number of F-18s</u>	<u>Actual Paint Usage in Quarts²</u>	<u>Normal Paint Usage for Standard Touch-up³</u>	<u>Number of Quarts Used in Excess of Standard</u>	<u>Percent of Paint Used in Excess of Standard</u>
VFA-15	12	279	104	175	268
VFA-22	12	418	104	314	401
VFA-25	10	242	87	155	279
VFA-27	12	340	104	236	326
VFA-82	12	398	104	294	382
VFA-83	11	258	96	162	270
VFA-86	12	171	104	67	164
VFA-87	12	338	104	233	324
VFA-94	12	260	104	156	249
VFA-97	12	354	104	249	339
VFA-106	45	1,240	293	946	423
VFA-113	10	309	87	222	355
VFA-125	40	758	261	497	291
VFA-131	11	266	96	170	278
VFA-136	10	245	87	158	282
VFA-137	12	241	104	136	231
VFA-146	11	450	96	354	470
VFA-147	11	630	96	535	660
VFA-151	12	452	104	348	434
Totals	279	7,649	2,239	5,407	

¹\$1.7 million is calculated by the average amount of excess paint costs per aircraft (5,407 divided by 279 aircraft multiplied by the cost to the Navy of \$30 per quart equals \$582) multiplied by 483 F/A-18 total aircraft in the Navy projected over the 6-Year Future Years Defense Program.

²This represents the actual amount of polyurethane based paint, in kits (each kit is approximately 1 quart or 32 ounces), issued to each F/A-18 squadron while shore based for the period August 1, 1995, through August 1, 1996. Although squadrons use other paints on F/A-18s, such as epoxy, polyurethane based paints are the most widely used in the Navy on F/A-18 aircraft.

³This represents the average amount of paint, in kits, that is needed to treat and prevent corrosion damage. For example, the corrosion treatment cycle for VFA-15 is every 42 days. Therefore, a squadron should use 1 kit per aircraft every 42 days, on average, for a total of 104 kits per year (365 days per year divided by 42 times 12 aircraft in the squadron).

Appendix D. Report Distribution

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Deputy Comptroller (Program/Budget)
Assistant Secretary of Defense (Public Affairs)
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Senate Committee on Governmental Affairs
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Committee on Government Reform and Oversight
House Subcommittee on National Security, International Affairs, and Criminal
Justice, Committee on Government Reform and Oversight
House Committee on National Security

Part III - Management Comments

Department of the Navy Comments



DEPARTMENT OF THE NAVY
OFFICE OF THE ASSISTANT SECRETARY
(Research, Development and Acquisition)
WASHINGTON, D.C. 20350-1000

MAY 19 1997

**MEMORANDUM FOR THE DEPARTMENT OF DEFENSE ASSISTANT
INSPECTOR GENERAL FOR AUDITING**

**Subj: AUDIT REPORT ON U.S. NAVY AIRCRAFT CORROSION PREVENTION
AND CONTROL PROGRAM (PROJECT NO. 4LB-0027.03)**

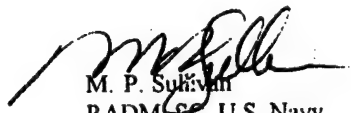
Ref: (a) DODIG Memo of 26 February 1997

Encl: (1) DON Response to Draft Audit Report

I am responding to the draft audit report forwarded by reference (a) concerning the Navy corrosion prevention and control program.

The Department of the Navy response is provided at enclosure (1). We generally agree with the draft report findings and recommendations. As outlined in the specific comments, the Department has taken or is planning to take specific actions regarding each recommendation.

While we agree that paint usage can be reduced to avoid some costs, the amount of potential savings cited may not be accurate. As outlined in the enclosure, there are several factors that effect total paint usage. These variables should be considered in determining the potential savings of reduced paint usage.


M. P. Sullivan
RADM, SC, U.S. Navy
Principal Deputy

Copy to:
FMO-31
NAVINSGEN (02)

Department of the Navy Response
to
DoDIG Draft Report of 26 February 1997
on
U. S. Navy Aircraft Corrosion Prevention and Control Program
(Project No. 4LB-0027.03)

Navy aircraft corrosion and prevention policy will be reiterated to squadron and wing commanders via official correspondence from the type commanders. Wing commanders will be tasked to include visual evaluation of paint systems during command inspections. Due date: 30 May 1997

Finding. The Navy painted its aircraft more than needed at the organizational level.

Recommendation 1: Direct that Naval aviation squadrons cease painting large sections of, or entire aircraft in hangars, and limit aircraft painting to minor touch-up.

DON Position: Concur. Policy concerning aircraft painting and touch-up are clearly outlined in the appropriate maintenance manuals.

Recommendation 2: Locate and use existing adequate facilities to paint Navy aircraft in their entirety when entire aircraft painting is needed.

DON Position: Concur. Except in highly unusual circumstances, entire aircraft painting should not be required outside of scheduled depot level maintenance periods (e.g., SDLM, MCAPP, etc.). If entire aircraft painting is deemed necessary, authority must be granted in writing by the Type Commander.

Recommendation 3: Direct base safety officers and fire safety officers at naval air stations to fully document all cases of complaints involving hazardous painting of aircraft in hangars so that station commanders can initiate appropriate corrective actions. Base safety officers and fire safety officers should also provide copies of safety hazard reports to the appropriate Naval Air Force commander.

DON Position: Concur. Reports are submitted via Commander, Shore Activities chain-of-command.

Recommendation 4: Direct Navy medical authorities and industrial hygiene officials to fully document suspected cases of isocyanate exposure and to report the information to senior Navy management.

DON Position: Concur. Any documented overexposure should be reported to the appropriate Naval Air Force commander.

Enclosure (1)

Remarks: Review of paint usage data as part of the audit process, as detailed in Appendix A of the draft report, may accurately capture the monetary value of paint and its potential impact on the environment, but it does not necessarily equate to the amount of paint actually applied to the aircraft. Connecting health risks to inflated usage data can also lead to false conclusions. There is a "scrap rate" associated with paint kits. Not all paint kits are successfully mixed and used; some chemically fail due to inappropriate environmental conditions, exceeding shelf life or hazardous material storage limits, not following mixing directions, improper surface preparation, or other reasons. More importantly, once a kit is mixed, actual usage depends upon individual aircraft requirements.

Audit Team Members

This report was prepared by the Logistics Support Directorate, Office of the Assistant Inspector General for Auditing, DoD.

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INTERNET DOCUMENT INFORMATION FORM

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OAG-AUD (ATTN: AFTS Audit Suggestions)
Inspector General, Department of Defense
400 Army Navy Drive (Room 801)
Arlington, VA 22202-2884

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